
MORRISTOWN NATIONAL HISTORICAL PARK

WATER RESOURCES SCOPING REPORT

Water Resources Division,

Coastal Research Center

and

Morristown National Historical Park

Technical Report NPS/NRWRD/NRTR-93/17

Water Resources Division



**National Park Service – Department of the Interior
Fort Collins – Denver – Washinton**

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Water Resources Division

National Park Service
Coastal Research Center
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in cooperation with:

Morristown National Historical Park

Technical Report NPS/NRWRD/NRTR-93/17

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EXECUTIVE SUMMARY

Morristown National Historical Park (MORR), located approximately 30 miles west of New York City, consists of four geographically separate areas, the two largest of which (the Jockey Hollow and New Jersey Brigade Encampment Areas) contain significant surface water resources. These two areas are located largely within the Great Swamp Watershed, which also contains the Great Swamp National Wildlife Refuge.

The upper watershed location and limited land-use within Morristown National Historical Park generally serve to protect the integrity and quality of the water resources within the Jockey Hollow and New Jersey Brigade Encampment Areas. While water resources lower in the Great Swamp/Passaic River watershed have been severely impacted by human-related activities, surface and ground water resources within Morristown National Historical Park generally remain in good condition.

However, the long-term impacts of upper watershed development upon the Passaic River and Indian Grave Brook, the potential impacts associated with adjacent (Military Hill) and within park development (National Park Service facilities) upon Primrose Brook, and the possible effects of runoff from Tempe Wick Road upon Jersey Brook constitute water resource issues that require management attention and appropriate long-term monitoring.

Water resources-related issues discussed in this report include:

- an assessment of potential water quality degradation from nonpoint source pollution related to land use;
- an evaluation of protection and management issues related to designated "Wild Trout" streams;
- an evaluation of wetland and riparian zone inventory and assessment requirements;
- an overview of water resources-related aspects of park development and operational activities.

While the development of a Water Resources Management Plan is not presently warranted, this report provides four water resources-related Project Statements (Appendix A) strongly recommended for inclusion in Morristown National Historical Park's Resources Management Plan (RMP).

INTRODUCTION

Morristown National Historical Park (MORR) is comprised of 1,685 acres situated in north-central New Jersey, approximately 30 miles west of New York City. The park contains four geographically separate units, each of which are associated with the 1777 and/or 1779-1780 winter encampments of the Continental Army (National Park Service 1976).

The Washington's Headquarter Area occupies 10 acres surrounded by an urban setting within Morristown. The Ford Mansion, located on this property, served as General Washington's winter headquarters from December 1779 to June 1780. In addition, this unit houses a historical museum and the National Historical Park's administrative offices.

The 35-acre Fort Nonsense Area marks the site of defensive trenches and raised embankments constructed on the crest of a hill strategically overlooking Morristown. While commanding excellent views of Morristown and the Watchung Mountains to the east, this unit is also surrounded by adjacent urban and suburban development.

The Jockey Hollow Encampment Area is located approximately 5 miles southwest of Morristown. This 1,320-acre site served as the 1779-80 winter camp for over 10,000 junior officers and soldiers that constituted the bulk of the Continental Army. At the time of the encampment, the site consisted of the Wick Farm, surrounded by forested hills which provided lumber, game, and water to the poorly supplied troops.

The 321-acre New Jersey Brigade Encampment Area is located approximately 2 miles southwest of Jockey Hollow. This site served as the encampment for the approximately 900 troops of the New Jersey Brigade who camped here on a steep plot of land during the winter of 1779-1780.

Because of their close proximity to Morristown, the Washington's Headquarter Area and Fort Nonsense Area have long been affected by the urban influence of the nearby town. The Jockey Hollow Encampment Area and New Jersey Brigade Encampment Area, however, are located in a formerly rural area, which for the last three decades, has been experiencing a rapid population increase brought about by the completion of new highways and improved access to New York City.

Changing land use patterns, associated with this development, have dramatically changed the character of the local area (CH2M HILL 1992). Surrounding lands, consisting primarily of rolling hills intersected by stream valleys and wetlands were, until recently, either farmed or covered with hardwood forests (Robichaud and Buell 1973). In recent years, the area has developed more of an "affluent-suburban" character, with open lands giving

way to low-density residential development (2+ acre, or 5+ acre lots), office parks and commercial development, and an expansion of recreational facilities such as golf courses. In addition, the once rural character of the local area has been heavily influenced by the expanding network of heavily travelled major roads and highways.

WATER RESOURCE SCOPING REPORT

Whether in support of natural systems or providing for visitor use, water is often a significant resource in units of the National Park System. Consistent with its fundamental purpose, the National Park Service (NPS) seeks to perpetuate surface and ground waters as integral components of the park aquatic and terrestrial ecosystems, by carefully managing the consumptive use of water and striving to maintain the natural quality of surface and ground waters in accordance with all applicable federal, state, and local laws and regulations. In addition, water-based recreation such as fishing, as well as the health of the aquatic ecosystem, are dependent upon the maintenance of adequate water quality.

Thus, water resource inventory and monitoring activities are integral components of resource management at Morristown National Historical Park. This Water Resources Scoping Report assists park management by:

- 1) providing an overview of existing water resource information,
- 2) identifying and discussing a number of water resource-related issues and management concerns, and 3) recommending a course of action for addressing water resource-related issues at Morristown National Historical Park. These proposed actions include recommending four water resource-related project statements which can be incorporated into the Morristown National Historical Park's Resource Management Plan (RMP) for future funding consideration.

DESCRIPTION OF WATER RESOURCES

a. Surface Water Resources

Significant surface water features in Morristown National Historical Park are found only within the Jockey Hollow and New Jersey Brigade Encampment Areas. These units are located largely within the upper reaches of the 55.6 square-mile Great Swamp Watershed (Figure 1), a subunit of the Upper Passaic River Basin (Anderson and Faust 1973).

Predominant surface water features within Morristown National Historical Park include: 1) most of the headwaters of the Primrose Brook

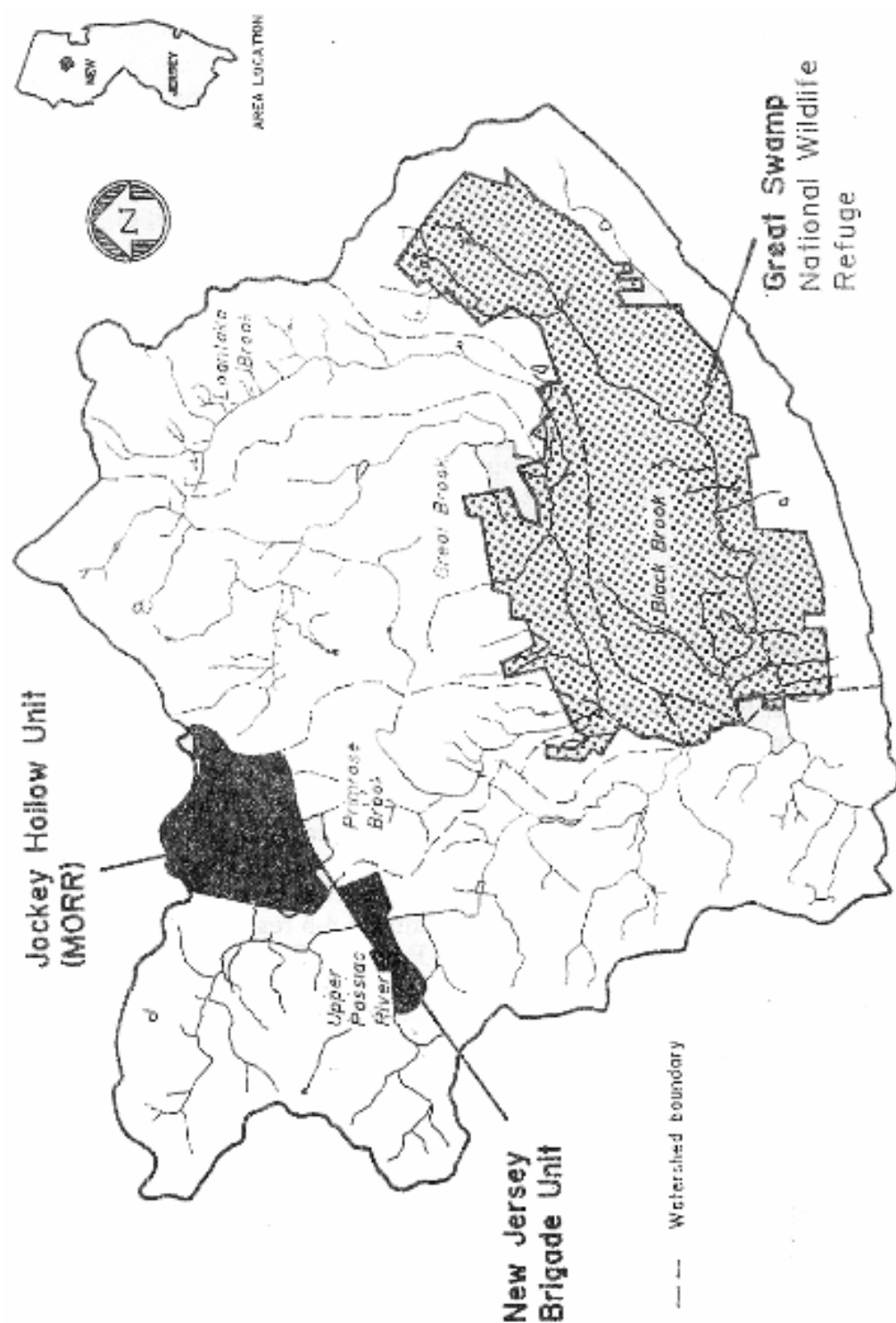


Figure 1. Major drainages of the Great Swamp Watershed (Upper Passaic Basin).

subwatershed, which include the East Branch Primrose Brook and the West Branch Primrose Brook; 2) the headwaters of Jersey Brook, a tributary to Primrose Brook; 3) a one-half mile reach of the Upper Passaic River, approximately one mile below Ledells Pond; and 4) a one-half mile section of Indian Grave Brook, a tributary of the Passaic River (Figure 2). In addition, a small artificial pond (Cat Swamp Pond) and two marshes are also located within the upper Primrose Brook drainage (Ehrenfeld 1977), while another small marsh is found adjacent to Indian Grave Brook within the New Jersey Brigade Encampment Area (Ehrenfeld and Dibeler 1987).

The headwaters of Primrose Brook emanate from a number of small natural springs which surface in the vicinity of Sugar Loaf and Mount Kemble in the Jockey Hollow Encampment Area. In its uppermost reaches, Primrose Brook consists of two branches; the East Branch Primrose Brook, and the West Branch Primrose Brook. While most of the springs contributing to these headwaters surface within the boundary of Morristown National Historical Park, the source spring of the East Branch Primrose Brook surfaces in an area known as Military Hill, which is located on private land just outside the northeastern boundary of the park.

The confluence of the East Branch Primrose Brook and the West Branch Primrose Brook occurs in the central portion of the Jockey Hollow Encampment Area, approximately one mile below their source. Primrose Brook then flows an additional one-half mile before exiting Morristown National Historical Park. Primrose Brook, one of the highest quality streams within the Great Swamp Watershed, is probably the least heavily human-influenced stream within Morristown National Historical Park (Trama and Galloway 1988). Except for a small area which contains 4-5 residences in the Military Hill vicinity, the entire watershed of the Primrose Brook headwaters is located within Morristown National Historical Park.

Jersey Brook, a tributary of Primrose Brook, originates from springs located in the southwestern portion of the Jockey Hollow Encampment Area. Jersey Brook flows less than 1,500 feet (ft) before exiting Morristown National Historical Park. Jersey Brook roughly parallels Tempe Wick Road from its source to its confluence with Primrose Brook, below the southern boundary of the Jockey Hollow Encampment Area. While the uppermost headwaters of Jersey Brook are located within Morristown National Historical Park, its water quality is likely influenced by road salts and other contaminants originating from Tempe Wick Road, a heavily travelled road which traverses the Jockey Hollow Encampment Area.

A one-half mile reach of the Passaic River bisects the New Jersey Brigade Encampment Area approximately one mile below Ledells Pond. The river

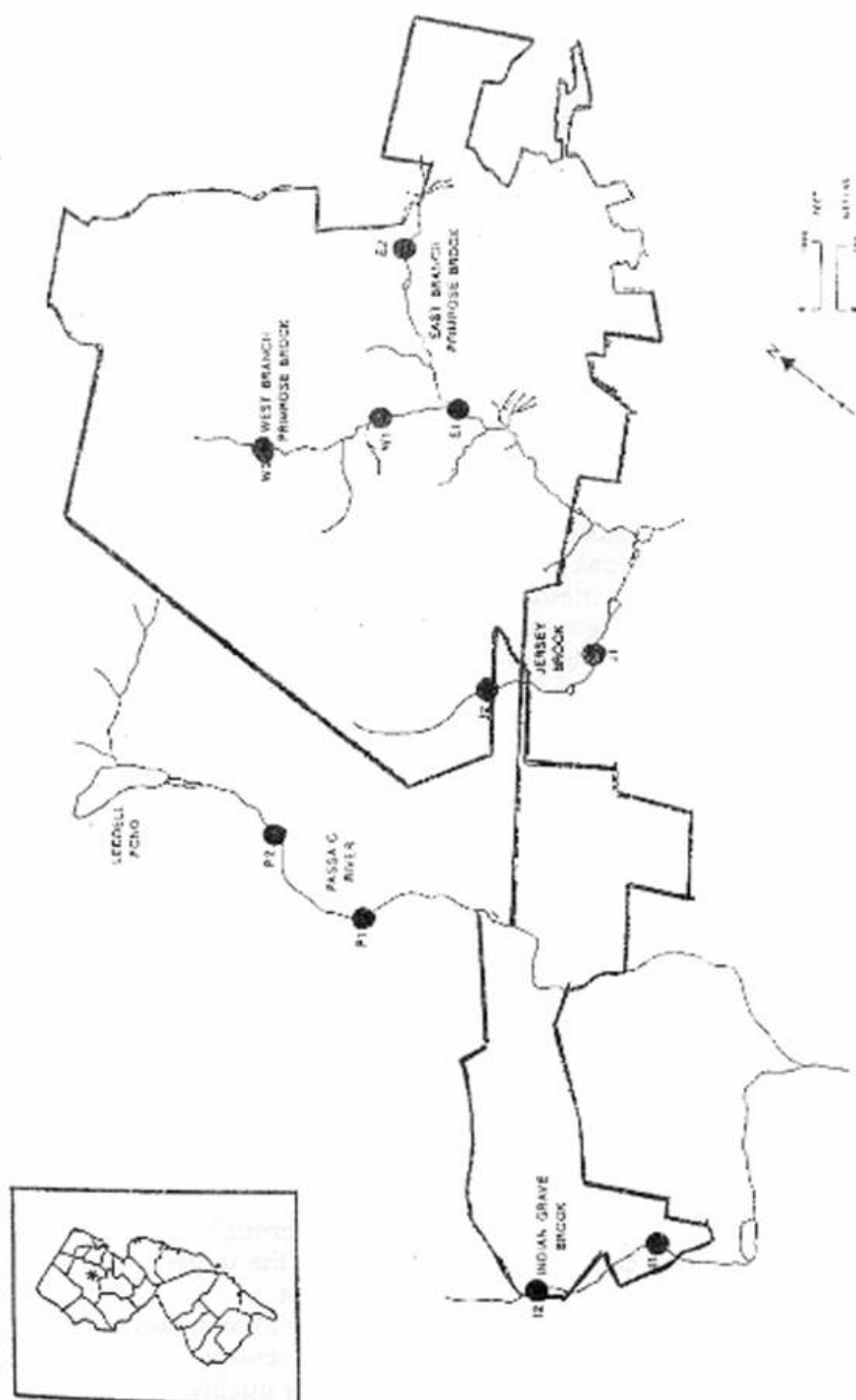


Figure 2. Predominant surface water features and sampling sites in the Jockey Hollow and New Jersey Brigade Encampment Areas of Morristown National Historical Park (Trama and Galloway 1986).

arises approximately 3 miles northwest of the New Jersey Brigade Encampment Area in Mendham Township. Land use above the park includes low-density residential development, a golf course, and a county park. The presence of Ledells Pond, an artificial impoundment located approximately one mile above the New Jersey Brigade Encampment Area, may also influence discharge and water quality in this river segment. Indian Grave Brook, a tributary of the Passaic River, arises approximately 1.2 miles northwest of the New Jersey Brigade Encampment Area. An approximately one-half mile reach of Indian Grave Brook roughly parallels the southwestern boundary of the New Jersey Brigade Encampment Area before flowing into the Passaic River 0.7 miles below the park. Its drainage area above the New Jersey Brigade Encampment Area includes an area of low-density residential development located between Hardscrabble Road and Claremont Road/ Ballentine Road in Mendham and Bernardsville Townships.

The New Jersey Surface Water Quality Standards (N.J.A.C. 7:9-4 et seq.) designates the segment of Primrose Brook from its source to the Lee's Hill Road bridge (including its Jersey Brook tributary) as FW-2 Trout Production Waters. Indian Grave Brook and the segment of the Passaic River from its source to Route 202 are currently designated as FW-2 Trout Maintenance Waters. Water quality criteria pertaining to these designations have been established for water temperature, pH, dissolved oxygen, total dissolved solids, suspended solids, chloride, sulfate, bacterial quality (Fecal coliform and *Enterococci*), petroleum hydrocarbons, and toxic substances including aldrin/dieldrin, ammonia, total arsenic, total barium, benzidine, total cadmium, chlordane, chlorine, total chromium, DDT (and metabolites), endosulfan, endrin, heptachlor, total lead, lindane, total mercury, PCB's, total selenium, total silver, toxaphene, and turbidity. The difference between the FW-2 Trout Production Waters and FW-2 Trout Maintenance Waters designations is that the FW-2 Trout Production Waters require more stringent water temperature and dissolved oxygen criteria.

In addition, the New Jersey Surface Water Quality Standards also classifies Primrose Brook, including its tributary Jersey Brook, as "Category One (anti-degradation) Waters". This designation is designed to protect these waters from measurable changes to existing water quality.

The high water quality generally found in the streams flowing through Morristown National Historical Park can be attributed largely to the upper watershed location of the Jockey Hollow and New Jersey Brigade Encampment Areas. No permitted National Pollutant Discharge Elimination System (NPDES) discharges are known to occur into any of the streams above the park. Thus, the slight degradation from natural water quality conditions noted at some of the sampling stations, are consistent with the

types of impacts often associated with nonpoint source contamination from roads and low-density residential development (Kunkle, et al. 1987).

Results of water quality inventory studies in the park have been reported by Mele and Mele (1983), Trama and Galloway (1988), and Galloway (1989). As noted in Table 1, these studies indicate that the streams within Morristown National Historical Park generally exhibit very good to excellent water quality, being well oxygenated at all times, circumneutral in pH, low-to-moderate in alkalinity, and containing low-to-moderate nutrient concentrations. Total suspended solids (TSS), total dissolved solids (TDS), specific conductance, and chlorides, while low in all streams, were slightly higher in Jersey Brook, Indian Grave Brook, and the Passaic River than they were in Primrose Brook (Trama and Galloway 1988). Increases in these parameters may be associated with the close proximity of Tempe Wick Road to Jersey Brook and the low-density residential development found in the uppermost reaches of the Upper Passaic and Indian Grave Brook subwatersheds.

Mele and Mele (1983) conducted quarterly fecal coliform bacterial monitoring at five stream locations from the fall of 1982 through the fall of 1983. Fecal coliform bacteria levels ranged from 0 to 150 colonies/100 milliliters (mL). While these levels are considered to be generally low, Mele and Mele (1983) suggest that the slightly elevated observations at the Jersey Brook and East Branch Primrose Brook sites might be associated with septic leachate.

Additional bacterial monitoring (fecal coliform and fecal streptococcus) was conducted quarterly by Trama and Galloway (1988) from the summer of 1986 through the summer of 1987. Again fecal coliform levels were found to be generally low with the exception of summer samples at two sites along the West Branch Primrose Brook, and a single summer sample exceeding 200 colonies/100 mL in each of Indian Grave Brook and Jersey Brook.

Trama and Galloway (1988) reported very low total recoverable aluminum concentrations in the stream water. While these concentrations pose no present threat to aquatic life, further analyses revealed high aluminum content in local soils. While it is unlikely that a serious threat of aluminum toxicity to the aquatic organisms in these streams exists, in the event that aluminum from the soil was mobilized, both water quality and aquatic biota could be impacted (Trama and Galloway 1988). No additional trace metal or organic contaminants data was found for the streams within Morristown National Historical Park.

Benthic algae are rarely abundant in Morristown National Historical Park's stream communities. Diatoms are reported to be the predominant algae, and maximum growth occurs during the spring (Trama and Galloway 1988).

Table 1. Surface water quality in Morristown National Historical Park for select parameters (data from Trama and Galloway 1988)

Stream	Annual Range						
	DO (mg/L)	pH	Cl (mg/L)	NO ₃ -N (mg/L.)	TP (ug/L)	PO ₄ -P (ug/L)	Fec Col (1100ml)
E. Primrose	9.1-13.5	7.0-7.9	2.5- 5.0	0.0- 0.41	7.5-27.1	0.0-10.6	3- 90
W. Primrose	9.0-14.1	6.8-7.8	2.7- 3.5	0.11-0.55	5.5-25.2	0.3-11.7	10-440
Indian Grave	9.3-16.0	6.7-8.0	10.3-16.1	0.25-1.00	6.0-61.2	0.0-16.5	1-283
Jersey Brook	7.9-14.0	7.1-7.7	13.8-26.8	0.17-0.42	6.5-87.0	0.7-16.7	11-210
Passaic River	8.3-15.6	7.2-8.1	9.4-23.9	0.18-0.84	8.5-44.0	0.0- 6.0	9- 91

Species found are those characteristic of shallow rocky streams exhibiting high water quality, and appear to form an excellent food base for the herbivorous aquatic macroinvertebrates occurring in these waters (Trama and Galloway 1988).

Stream benthic macroinvertebrate communities within Morristown National Historical Park were surveyed by both Mele and Mele (1983) and Galloway (1989). The types of benthic fauna collected in both surveys indicate a typical stony or hard-bottom habitat supporting a number of pollution intolerant indicator species of ephemeropterans (mayflies), plecopterans (stoneflies), and trichopterans (caddis flies). Galloway's (1989) thorough evaluation of community structure indicates that all streams within Morristown National Historical Park support healthy, diverse, and abundant macroinvertebrate communities.

No rooted aquatic macrophytes were observed at any sampling site by Trama and Galloway (1988). The absence of these plants could be due to swift currents, rocky substrates, changing water levels, low nutrient availability and/or limiting amounts of solar radiation during the growing season. However, an aquatic moss, *Fontinalis sp.*, is common, and liverworts are sometimes found on exposed rocks in the stream channel or along the wet banks (Trama and Galloway 1988).

Mele and Mele (1983) conducted fish surveys in the Passaic River, Indian Grave Brook, East Branch Primrose Brook, and West Branch Primrose Brook stream segments within Morristown National Historical Park. Their data indicate that the spottail shiner (*Notropis hudsonius*) ranks first in abundance (28.9 percent), the Eastern brook trout (*Salvelinus fontinalis*) second (22.2 per-cent), the rainbow trout (*Salmo gairdneri*) third (15.2 percent), the mottled sculpin (*Cottus bairdi*) fourth (12.8 percent), and the brown trout (*Salmo trutta*) fifth (8.5 percent). There are, however, pronounced differences of relative species abundance among the sampling sites. Of the three species of trout identified, rainbow trout dominated (37.2 percent) at the Indian Grave Brook site, brown trout were found to be most abundant (23.5 percent) at the Passaic River site, and Eastern brook trout accounted for more than 50 per-cent of the fish observed in the two Primrose Brook sampling sites (Mele and Mele 1983). Also, the mottled sculpin, which was the second most common species at the Primrose Brook sites was encountered only once each at the Indian Grave Brook and Passaic River sites (Mele and Mele 1983). These differences in relative abundance suggest that each stream system has its own unique hydrological and microhabitat characteristics which strongly influence fish species composition.

Mele and Mele (1983) observed thirteen species of amphibians and reptiles associated with their sampling sites during their study. The most commonly observed species included the redback salamander (*Plethodon cinereus*), Jefferson's salamander (*Ambystoma jeffersonianum*), the northern two-lined salamander (*Eurycea bislineata*), the green frog (*Rana clamitans*), and the slimy salamander (*Plethodon glutinosus*). Less common species observed included the red-spotted newt (*Notophthalmus viridescens*), the northern dusky salamander (*Desmognathus fuscus*), the northern leopard frog (*Rana pipiens*), the snapping turtle (*Chelydra serpentina*), the box turtle (*Terrapene carolina*), the eastern garter snake (*Thamnopsis sirtalis*), and the northern water snake (*Natrix sipedon*).

Cat Swamp Pond is the only existing open water pond within Morristown National Historical Park. This small pond, located in a low area adjacent to the East Branch Primrose Brook, is a remnant of the water collection and storage system that was built as part of the Morristown Aqueduct Water System. Cat Swamp Pond is surrounded by a constructed berm. It has no natural drainage and its water level is presumably maintained by a high water table. While Cat Swamp Pond has no natural outlet, it is connected to East Branch Primrose Brook by an overflow outlet pipe along the eastern edge of the berm (Ehrenfeld 1977).

The water in Cat Swamp Pond is tannin-stained and probably acidic due to a heavy influx of leaf litter and a negligible rate of water exchange. Ehrenfeld (1977) reports Cat Swamp Pond as being remarkably devoid of flora and fauna, possibly caused by deoxygenated conditions brought about by high amounts of natural decomposition and the low water exchange rates. While it is an artificial surface water feature, Cat Swamp Pond has now been integrated into the surrounding ecosystem for over a century. Attempts to either remove this feature, or to make Cat Swamp Pond into a more biologically productive body of water is not warranted at this time.

While no rare or endangered amphibians or reptiles are known to occur within the park, staff biologists from Great Swamp National Wildlife Refuge should be consulted to see if Cat Swamp Pond could serve as possible habitat for the endangered Muhlenberg's bog turtle (*Clemmys muhlenbergi*) or the state-listed blue-spotted salamander (*Ambystoma laterale*). While not known to exist within the park, both species have been found in other parts of southern Morris County.

b. Ground Water Resources

From the regional perspective, the most productive and intensively utilized aquifers in north-central New Jersey are the buried valley aquifers composed of unconsolidated sand and gravel deposits from the Quaternary Period,

which have filled pre-Pleistocene channels (Gill, et al. 1965). These aquifers are important, as they provide the primary water supply to many of the communities and scores of local industries in the area around Morristown National Historical Park (Van Abs 1983). In addition, other important ground water aquifers occur throughout the region in fractures within the Precambrian, Triassic, and Paleozoic rocks. These aquifers also may yield substantial quantities of ground water (Gill and Vecchioli 1965).

Both the Jockey Hollow and New Jersey Brigade Encampment Areas contain a number of natural springs and seeps emanating from the shallow aquifer. From the historical perspective, these springs provided an important water supply to the encamped Continental Army. In the 1890s, a growing Morristown began to utilize these natural springs as the town's water supply. A series of trenches and ponds were constructed in order to facilitate the collection and storage of water which then flowed to Morristown via the Morristown Aqueduct Water System. This aqueduct system was abandoned in 1933, but remnants including iron pipes, collection trenches and vaults, and storage ponds still remain.

Park visitor facilities, administrative buildings, and residences all rely upon ground water wells for water supply. While little information is available regarding local ground water use, there are no known well fields or other significant withdrawals in the general vicinity of the Jockey Hollow and New Jersey Encampment Areas (Mele and Mele 1983). However, the effects of periodic droughts on the local aquifers are a regional concern (Vecchioli and Nichols 1966; Canace, et al. 1983), and local proposals for well field development or other significant ground water withdrawals should be closely monitored.

In addition, in recent years, the NPS has been forced to limit use of water in two shallow ground water wells (Quarters #62 and Soldier Huts) located within the park, because of high bacterial levels indicating possible contamination. The source of this possible contamination has not been determined.

C. Wetland and Riparian Resources

Ehrenfeld (1977) identified two small marshes within the Jockey Hollow Encampment Area and Ehrenfeld and Dibeler (1987) reported an additional small wetland adjacent to Indian Grave Brook within the New Jersey Brigade Area of Morristown National Historical Park.

The first marsh, located on the West Branch of Primrose Brook, was formerly a holding pond of the Morristown Aqueduct Water System. Drained when

the system was abandoned in the 1930s, this marshy site is currently dominated by forested wetlands including black willows and other wet site trees and shrubs. Ehrenfeld (1977) predicts that this site will revert back to forest during the next few decades.

The second marsh is located below Cat Swamp Pond on the East Branch of Primrose Brook. The probable existence of this marsh before the aqueduct system, its soil character, and the lack of colonization by trees indicate that this marsh may be a permanent landscape feature (Ehrenfeld 1977). While neither of these features have been accurately delineated, the presence of the second marsh is indicated on a 1980 surface water map of the Jockey Hollow Encampment Area (Malanka 1980).

Ehrenfeld and Dibeler (1987) identified a small area of forested wetland within the New Jersey Brigade Unit at the intersection of Indian Grave Brook and a small feeder stream which runs southwest from Patriot's Path. This wetland area, which lies in an area of saturated soils, is of ecological significance because of its contribution to species and habitat diversity.

In addition, Ehrenfeld indicates the presence of relatively extensive riparian areas (stream thickets), associated with Primrose Brook, on her vegetation maps of the Jockey Hollow Encampment Area (1977) and along the floodplain of Indian Grave Brook within the New Jersey Brigade Unit (Ehrenfeld and Dibeler 1987).

Wetland resources in the vicinity of Morristown National Historical Park were also mapped (1:24000 scale) in 1976 as part of the U.S. Fish and Wildlife Service's (FWS) National Wetland Inventory (NWI). Morris County is quite rich in wetland resources (13 percent of the county), due in part to the location of Great Swamp National Wildlife Refuge situated downstream of Morristown National Historical Park (Tiner 1985).

WATER RESOURCE PLANNING ISSUES AT MORRISTOWN NATIONAL HISTORICAL PARK

Water Resources Division, North Atlantic Region, and Morristown National Historical Park personnel held an initial water resource scoping session at Morristown National Historical Park from December 2-4, 1991. The purpose of this session was to gain familiarity with Morristown National Historical Park's water resource features and to identify water resource issues and management concerns. Subsequent discussions have been held with additional NPS personnel, federal, state, and county officials, and other water resource professionals in order to further refine potential water resource issues and develop alternatives pertaining to these issues.

Specific water resource issues identified for consideration in this Water Resources Scoping Report include:

- ◆ adequacy of the current water quality program for monitoring potential degradation resulting from nonpoint source pollution related to changing land use;
- ◆ protection and management of waters designated as "Special Trout Streams; "
- + wetland and riparian resource delineation and management;
- ◆ water resource issues related to park operations and development.

1- Adequacy of the Current Water Quality Program for Monitoring Potential Water Quality Degredation from Nonpoint Source Pollution Related to Changing Land Use

While generally high water quality exists within the streams flowing through Morristown National Historical Park, changing land-use patterns have generated serious point source and nonpoint source water quality problems in other areas within the Upper Passaic River/Great Swamp watershed. Within the National Historical Park, there is concern that nonpoint source pollutants associated with surrounding suburban sources could impact the existing high water quality. These sources include potential contamination from subdivision/commercial development, highway runoff, application of golf course, lawn and garden chemicals, septic system leachate, and leaking underground storage tanks.

Subdivision/commercial development often results in the reduction of infiltration areas, which can increase stormwater runoff and alter discharge and hydrologic patterns. This, in turn, may lead to additional sediment loading and channel scour in the receiving stream. In addition, improperly designed slope development or poor construction practice can also increase surface erosion and sediment load. For example, in 1987, the illegal breaching of a pond at a residential construction site in the Military Hill vicinity resulted in the discharge of sediment-laden waters into the East Branch Primrose Brook (Morristown National Historical Park Case Incident Report 870169). Excessive siltation resulting from this release was noted from the source of the East Branch Primrose Brook to south of Route 287 (Lynn Wightman, Morristown National Historical Park, personal communication).

Many of the residences and estates surrounding the park also contain expansive lawn areas, which regularly receive applications of lawn chemicals including fertilizers, pesticides, and lime. Little information is currently available regarding the type or amounts of chemicals applied, or the potential for runoff of these chemicals into adjacent streams (Greg Westfall, U.S. Department of Agriculture, Soil Conservation Service, personal communication). As an initial step in addressing potential water contamination issues resulting from these applications, the Great Swamp Watershed Study, recently established by the state of New Jersey, is currently supporting research to quantify the types and amounts of these chemicals being utilized by home owners, golf courses, and commercial applicators within the Upper Passaic River/Great Swamp watershed (Dr. Barbara Grandin, Department of Human Ecology, Rutgers University, personal communication).

Contaminants frequently associated with stormwater runoff from highways and parking areas associated with commercial development include total suspended solids, heavy metals (especially lead, zinc, and copper), polycyclic aromatic hydrocarbons (PAHs), and road salts (Ball, et al. 1991). Of particular concern at Morristown National Historical Park, is the close proximity of Tempe Wick Road to the waters of the Jersey Brook/Primrose Brook system.

Septic tank leachate presents another possible source of water contamination. Visitor facilities, administrative buildings, and employee residences within Morristown National Historical Park rely upon septic systems and leach fields for sewage disposal. Residential and commercial development in the surrounding communities also rely upon septic systems. Previous studies (Mele and Mele 1983; Trama and Galloway 1988) have detected occasional bacterial contamination in Jersey Brook, Primrose Brook, and Indian Grave Brook and water supply monitoring has found occasional contamination in some park wells. While the source of this possible contamination remains unknown, it could be associated with inadequate septic systems or the large number of wildlife found within the Jockey Hollow and New Jersey Brigade Encampment Areas.

Residential and commercial development within the watershed has also led to the installation of numerous underground tanks for the storage of petroleum products including heating oil and gasoline. Leaks from these tanks have sometimes been associated with localized ground water contamination in many areas throughout the watershed.

In their assessment of Morristown National Historical Parks's aquatic resources, Trama and Galloway (1988) provided the park with a series of

recommendations for long-term water quality monitoring and management. An important part of these recommendations was the establishment of a systematic water quality monitoring program which consists of a monthly monitoring program for key parameters including temperature, pH, dissolved oxygen, and specific conductance, supplemented on a periodic (10 year) basis by an intensive chemical and biological survey and assessment.

These recommendations were adopted by the National Historical Park in 1988 with the establishment of a "10 station monthly sampling program" (NPS 1988). The purpose of this program was to provide a long term record for a minimal set of key parameters which might serve to flag water quality impacts or deteriorating water quality. In addition, the familiarity with stream conditions and visual observations of park staff obtained during monthly monitoring visits might also prove useful in detecting possible stream quality deterioration.

While the field portion of the monthly monitoring program was successfully implemented, the monitoring effort lacks an adequate quality assurance! quality control (QA/QC) program, and does not provide a mechanism for effective data interpretation and reporting. The QA/QC, data management, and data interpretation problems experienced in the existing program are not unique to Morristown National Historical Park. Rather, these problems have been encountered in many NPS units where staffing and/or resources have not been sufficient to adequately implement monitoring programs, assure proper QAIQC, sufficiently evaluate, analyze and report data, and to work with the appropriate regulatory authorities when corrective action is necessary.

In addition, the limited number of parameters monitored may not adequately address the types of contamination often associated with nonpoint source pollution. While a program to monitor all of the possible impacts from the various nonpoint sources would be extremely costly and is not warranted, it is recommended that the park implement a modified long-term monitoring program designed to: (1) continue to "flag" potential degradation resulting from nonpoint source contamination, (2) provide a more complete assessment of baseline water quality, (3) periodically appraise the health of the aquatic biological community, (4) incorporate appropriate quality QA/QC procedures, and (5) be implemented in such a manner that the data collected are comparable to data from other existing state and federal monitoring efforts being undertaken within the Great Swamp Watershed.

Many states are currently implementing voluntary environmental monitoring programs in which the state provides citizen volunteers with the training, equipment, and QA/QC support necessary to obtain basic water quality

monitoring data that can be incorporated into a statewide database. These programs have been most effective in "flagging" potential water quality degradation in order that state regulators may be more aware of where problems may be occurring. It is recommended that Morristown National Historical Park investigate the possibility of linking their monthly monitoring efforts with a cooperative state of New Jersey/NPS/Interested Citizen Program in order to expand monitoring efforts to areas within the Passaic River watershed above the National Historical Park's boundary. Such a cooperative relationship could also provide NPS personnel with additional training, necessary QA/QC support, and possible access to volunteer assistance to support monthly monitoring activities. In addition, the potential use of currently available "Challenge Cost Share" funding sources makes the implementation of such a cooperative program highly attractive.

The FWS has recently initiated (1991) a program to monitor 15 physical, chemical, and biological parameters (streamflow, water temperature, pH, specific conductance, dissolved oxygen, alkalinity, hardness, turbidity, ammonia, nitrite, nitrate, phosphate, chloride, chlorine, and benthic macroinvertebrates) at 16 sites throughout the Great Swamp Watershed. The purpose of this program is to evaluate the quality of water flowing into Great Swamp National Wildlife Refuge (Craig Moore, FWS, personal communication). One site (FWS Site 165) is located on Primrose Brook (NPS Site E-1) within Morristown National Historical Park. This relatively unimpacted site serves as a background baseline site, used for comparison with impacted sites lower on Primrose Brook and on other tributaries to the Great Swamp National Wildlife Refuge. Morristown National Historical Park should investigate the possibility of working with the U.S. Fish and Wildlife Service to expand this quarterly program to 5 additional NPS-funded sites (in addition to NPS Site E-1) within the National Historical Park. Recommended sites include NPS Site W-1, NPS Site E-2, NPS Site I-2, NPS Site P-1, and NPS Site J-2 (Figure 2). Additional sites should also be considered for critical stream areas above the National Historical Park's boundary. The methods chosen for the determination of nutrient concentrations should be sensitive enough to detect change from the existing high quality levels.

The New Jersey Department of Environmental Protection and Energy has recently initiated a Level II Rapid Bioassessment Program (Plafkin, et al. 1989) throughout the state including locations along the Upper Passaic River, Indian Grave Brook, and Primrose Brook (Jack Kurtz, New Jersey Department of Environmental Protection, personal communication). Level II Rapid Bioassessment provides an inexpensive and cost-effective method for identifying those stream reaches whose biological integrity has been affected by water quality degradation. Because of its statewide scope, it is anticipated that stream segments will be monitored only once every 5 years as part of

this program. Implementing similar monitoring at the six sites listed above on an annual basis would provide the National Historical Park with a good long-term indicator of the health of the aquatic biological communities. Intensive studies, similar to those recommended by Trama and Galloway (1988) (and which could also include expanded invertebrate, fisheries, and toxicological surveys) would then be necessary only on a periodic, 15-20 year basis, or in response to a significant change in water quality trend.

The U.S. Geological Survey (USGS) is also presently implementing the National Water Quality Assessment (NAWQA) program. The Hudson Basin, in which Morristown National Historical Park is located, is one of the first 20 large river basin studies initiated by the USGS as part of the NAWQA program. A Morristown National Historical Park site could possibly serve as a background site for the NAWQA program in a manner similar to how NPS Site E-1 is currently used by the FWS for as a background site for their Great Swamp National Wildlife Refuge watershed monitoring program. Further information about the NAWQA program is available from the Water Operations Branch of the NPS's Water Resources Division.

Project Statement MORR-N-001 (Appendix A) addresses the resources necessary to implement the cooperative water quality monitoring program recommended above.

2- Protection and Management of Designated Wild Trout Streams

Mele and Mele (1983) reported that surface waters within Morristown National Historical Park support a diverse and balanced fish community including the native Eastern brook trout (*Salvelinus fontinalis*), and two introduced salmonids, the rainbow trout (*Salmo gairdner*) and brown trout (*Salmo trutta*).

The waters within Morristown National Historical Park are protected by the State of New Jersey Water Quality Standards. Primrose Brook, and its tributary Jersey Brook, are currently designated as FW-2 Trout Production Waters, affording relatively strong water quality regulatory protection. While the Passaic River (source to Route 202) and Indian Grave Brook are presently designated as FW-2 Trout Maintenance Waters, recent electrofishing surveys conducted by the New Jersey Division of Fish, Game and Wildlife confirmed the presence of reproducing populations of rainbow trout and brown trout in the Upper Passaic River, and of rainbow trout in Indian Grave Brook (Bob Papson, New Jersey Division of Fish, Game and Wildlife, unpublished data). Based upon this information, the New Jersey Division of Fish, Game and Wildlife has recommended the designation of Indian Grave Brook and the segment of the Passaic River from its source to Route 202 (including that

segment which flows through the New Jersey Brigade Unit) be upgraded from FW-2 Trout Maintenance Waters to FW-2 Trout Production Waters (Bob Papson, New Jersey Division of Fish, Game and Wildlife, personal communication). The New Jersey Department of Environmental Protection and Energy is currently evaluating *this* recommendation and is expected to propose the change in designation before the end of 1993 (Girija Mallepalle, New Jersey Department of Environmental Protection and Energy, personal communication). However, while Primrose Brook is *presently* recognized as Category One (antidegradation) Waters, this is not the case for the Passaic River (source to Route 202). It is recommended that the NPS seek this important designation in order to more fully protect these waters in their current high quality condition.

In 1992 the state of New Jersey listed Indian Grave Brook and the Passaic River (source to Route 202) as "Wild Trout Streams". This designation both serves to identify stream segments supporting viable wild trout populations capable of supporting a limited sport fishery and to provide an additional level of protection to these wild trout populations by eliminating fish stocking activities and establishing more stringent fishing regulations. Primrose Brook and Jersey Brook were not included in this special designation as their sport fishing potential is minimal due to the relatively low flow and the small size of the trout found in these waters (Bob Papson, New Jersey Division of Fish, Game and Wildlife, personal communication). Subsequently, state fishing regulations are less stringent in Primrose Brook and Jersey Brook than in Indian Grave Brook and the Upper Passaic River.

Mele and Mele (1983) reported that more than 50 percent of the fish sampled during a survey of the East Branch Primrose Brook and West Branch Primrose Brook were Eastern brook trout (*Salvelinus fontinalis*). The Eastern brook trout is the only native trout found in New Jersey and is a state-listed threatened species due to loss of habitat. Fish surveys conducted in Primrose Brook by the New Jersey Division of Fish, Game and Wildlife in 1992, confirmed the presence of reproducing populations of both the Eastern brook trout and brown trout at the confluence of the Eastern Branch Primrose Brook and the Western Branch Primrose Brook (NPS Site E-1) (Bob Papson, New Jersey Division of Fish, Game and Wildlife, unpublished data). However, the distribution of the Eastern brook trout appears limited to the upper reaches of Primrose Brook, since surveys undertaken in 1987 at sites approximately one-half mile and one mile below the boundary of Morristown National Historical Park did not yield Eastern brook trout (Bob Papson, New Jersey Division of Fish, Game and Wildlife, unpublished data).

It should also be noted that Mele and Mele (1983) report the mottled sculpin (*Cottus bairdi*) as the second most common fish in the Eastern Branch and

Western Branch Primrose Brook. However, the 1992 survey conducted reports the slimy sculpin (*Cottus cognatus*) as the most common fish found at the confluence of the two branches (Bob Papson, New Jersey Division of Fish, Game and Wildlife, unpublished data). Since it is somewhat difficult to distinguish between these two species, it is probable that both studies refer to the same species. However, positive identification of the sculpin species found within Primrose Brook is recommended.

It is recommended that Morristown National Historical Park continue its cooperation with the state of New Jersey in order to protect the water quality and fishery resources within the waters of Morristown National Historical Park. The NPS should request that the New Jersey Department of Environmental Protection and Energy consider classifying the segment of the Passaic River from its source to Route 202 as Category One (antidegradation) Waters. In addition Morristown National Historical Park should also continue to cooperate with the New Jersey Division of Fish, Game and Wildlife to periodically resurvey fish populations with the National Historical Park's waters. In addition, while fishing in Primrose Brook is not common, the NPS and New Jersey Division of Fish, Game and Wildlife need to evaluate if special fishing regulations are appropriate in order to protect the range-limited but viable population of Eastern brook trout found in the Primrose Brook headwaters. The establishment of a "no fishing" regulation for the Primrose Brook headwaters should be strongly encouraged.

Project Statement MORR-N-022 (Appendix A) addresses the need for cooperation in pursuing these resource-related regulatory issues.

3- Wetland and Riparian Resource Delineation and Management

Wetlands and riparian zones represent important community types within Morristown National Historical Park. Ecologically, they provide habitat for a diversity of flora and fauna. At the local and regional levels, the National Historical Park's wetlands provide for landscape diversity. In terms of water quality, wetlands can improve or *maintain* water quality by nutrient removal and retention, chemical and microbial processing of some organic constituents, and by trapping and reducing suspended sediment loads. The sociocultural value of wetlands is also important; particularly their role wetlands play in natural flood control, by storing flood waters and slowing flood flows. This issue of flooding is particularly relevant in the lower Passaic River watershed. The values and functions of inland wetlands have been reviewed in detail elsewhere (liner 1985; Mitch and Gosselink 1986).

The first step toward effective protection of Morristown National Historical Park's wetlands involves a careful mapping and field inventory. National

Wetland Inventory maps are available, yet the scale (1:24,000) is not adequate to detect subtle changes that may be occurring with respect to habitat boundaries or species composition changes. It is recommended that wetlands of the park be mapped using fairly large scale aerial photography (perhaps 1 inch = 400 ft). Ideally, this mapping should be done in conjunction with a parkwide vegetation or land cover map, with wetlands representing just a few of many cover types. Recently, this type of mapping was successfully completed at Minute Man National Historical Park (Massachusetts); a park of similar size and land use to that of Morristown. Upon completion of the map, a field inventory should be performed to focus on hydrological characteristics (surface and ground water levels), soils, plant species composition and vegetation structure of various wetland types, small mammal surveys and herpetofaunal surveys. Particular attention to rare species occurrences and notation of critical habitat characteristics is recommended.

Given a baseline map and detailed field inventory, coupled with a routine monitoring program, staff resource managers will be able to detect the response of wetlands to various natural and human-induced disturbances. For example, how will the wetland and riparian zone respond over the long-term to intense deer browsing? Are wetland surface and ground water levels increasing due to adjacent development activities? What is the response of vegetation composition, structure and wetland boundaries to changing hydrological, water quality and climatic factors?

Project Statement MORR-N-020 (Appendix A) addresses the need for the recommended wetlands inventory and assessment activities.

4- Water Resource Issues Related to Park Operations and Development

a. Water Systems

Water is supplied at the Jockey Hollow and New Jersey Brigade Encampment Areas via ground water wells with attached chlorinator systems. Public non-community water supplies consist of wells at the Jockey Hollow Visitor Center (which also supplies the Quarters #35 employee residence) and a well which supplies the Jockey Hollow Comfort Station, the maintenance yard, the Guerin House (Quarters #8), and the Quarters #10 employee residence. In addition, individual ground water wells also supply non-public systems at Quarters #62, Quarters #65, Quarters #43, Quarters #44, Quarters #45, and the Cross Estate Main House (Quarters #46) employee residences.

Water quality is monitored in both the public non-community and non-public water supplies in accordance with guidelines presented in NPS-83 (NPS 1991). Coliform bacteria are monitored twice per month in the public non-community water supplies and once per month in the non-public systems. In addition, water chemistry analyses are conducted on a periodic basis by a contract lab (Brian Brodhead, Morristown National Historical Park, personal communication).

The present system of ground water wells generally provide an adequate water supply. A former, periodic supply problem at the Cross Estate was recently remedied by providing a separate (non-chlorinated) well to supply water used exclusively to support the sprinkler irrigation system at the Cross Estate Formal Gardens.

b. Sewage Systems

Sewage disposal at visitor facilities, administrative buildings, and residences within the Jockey Hollow and New Jersey Brigade Encampment Areas is accomplished largely via individual septic systems which discharge to nearby drainage fields.

The largest sewage disposal systems are located at the Jockey Hollow Visitor Center (3 septic tanks), the Jockey Hollow Comfort Station (2 septic tanks), the Cross Estate (2 septic tanks), and Quarters #45 (2 septic tanks).

Individual septic tanks are located at the maintenance facility and each of the individual employee residences in the Jockey Hollow Encampment Area (Quarters #35, Quarters #8, Quarters #10, Quarters #62) and New Jersey Brigade Encampment Area (Quarters #43 and Quarters #44) .

The Jockey Hollow Visitor Center and Jockey Hollow Comfort Station were constructed in the late 1970s. System capacity is adequate, though large school groups have, on occasion, generated system malfunction alarms, but have never resulted in sewage overflow. The septic system at the Cross Estate Main House (Quarters #46) was also installed recently and provides adequate capacity.

However, the septic systems at the maintenance yard and other employee residences are older, dating from the 1930s to 1960s, and may require replacement. The location of leach fields associated with some of these individual systems could also provide a source of contamination to nearby springs and surface waters. Of particular concern are systems at employee residences located close to Primrose Brook and the septic system at

Quarters #45 where the leach field is located just beneath the surface in an area less than 100 ft from Indian Grave Brook. These systems could be potential sources of contamination during certain hydrological conditions (i.e., high seasonal water table).

Project Statement MORR-N-020 (Appendix A) addresses the need for a study to assess the possible bacterial contamination issues noted during previous research and well monitoring activities and to identify the probable sources of contamination.

c. Hazardous Materials Management

Morristown National Historical Park contains a number of underground storage tanks (UST), many of which were inherited from private property owners as land was acquired. A 1991 survey revealed 13 known USTs within the park, including 11 used to store fuel oil, one used to store gasoline, and one formerly used to store propane (Morristown National Historical Park, unpublished data).

The integrity of one 6,000-gallon fuel oil storage tank located at the museum is suspect, as the tank has water entering (contaminating the fuel) but does not appear to yet be leaking fuel. Actions to remove this tank are underway, and the museum building has been converted to natural gas. Plans have also been prepared to convert two additional park residences to natural gas.

The location of a 1,000-gallon underground gasoline storage tank and a 1,500-gallon underground fuel oil tank at the Jockey Hollow Maintenance Facility present a concern, as these tanks are located upgradient and in relatively close proximity (700 ft) to Primrose Brook.

Maintenance activities at Morristown National Historical Park also generate small quantities of oil and hazardous materials such as paints, solvents, and used batteries. Used oil is stored in an above-ground tank at the Maintenance Facility, where it is tested for contamination and recycled by a private contractor. The small amounts of paints and solvents needing disposal are allowed to dry in their cans and then disposed of by Harding Township during their periodic hazardous waste disposal drives.

An old landfill site is located on New Jersey Audobon Society property adjacent to the boundary of the New Jersey Brigade Encampment Area. The site is located near the Passaic River and a preliminary analysis of soil samples found elevated concentrations of lead and PCB's. Further soil testing along the bed of the Passaic River will be conducted in 1993

(Bob Masson, Morristown National Historical Park, personal communication). An additional former dump site has also recently been identified in the New Jersey Brigade Unit near the Cross Estate.

The Integrated Pest Management (IPM) activities at Morristown National Historical Park allow for limited applications of pesticides in the Wick Farm Orchard including Captan (N-trichlorormethyl mercapto-4-cyclohexene-1, 2-dicarboximide) and Dormant Oil, and on the hemlocks at the Cross Estate (Dormant Oil). In addition, dusting is allowed to address structural infestation by ants. Types and amounts of pesticides applied conform with NPS, IPM guidance and application/disposal activities conform with the product's EPA-approved label instructions (Bob Masson, Morristown National Historical Park, personal communication).

No additional hazardous materials issues are known to exist within the park (Brian Brodhead, Morristown National Historical Park, personal communication).

RECOMMENDATIONS

The upper watershed location and limited land-use within Morristown National Historical Park generally serve to protect the integrity and quality of the water resources within the Jockey Hollow and New Jersey Brigade Encampment Areas. While water resources lower in the Passaic River/Great Swamp watershed have been severely impacted by human-related activities, surface and ground water resources within Morristown National Historical Park generally remain in good condition. Because of this, the development of a Water Resources Management Plan is not felt to be necessary at the present time.

However, the long-term impacts of upper watershed development upon the Upper Passaic River and Indian Grave Brook, the potential impacts associated with adjacent (Military Hill) and within park development (NPS facilities) upon Primrose Brook, and the possible effects of runoff from Tempe Wick Road upon Jersey Brook constitute water resource issues that require management attention and appropriate long-term monitoring.

It is recommended that the National Historical Park modify its current long-term monitoring program in a manner that will: (1) "flag" potential degradation resulting from nonpoint source contamination, (2) provide a more complete assessment of baseline water quality, (3) periodically appraise the health of the aquatic biological community, (4) incorporate adequate Quality Assurance/Quality Control (QA/QC) procedures, and (5) be implemented in such a manner that data collected be comparable to those

gathered in other regional state and federal monitoring efforts being conducted within the Great Swamp Watershed.

Project Statement MORR-N-001: Monitoring Long-Term Water Quality Trend (Appendix A) recommends the possible linking of Morristown National Historical Park's existing monthly monitoring program with a state-sponsored Volunteer Monitoring Program in which the state could possibly assist by providing training, a QA/QC program, data management support, and access to citizen volunteers. In addition, the National Historical Park is encouraged to implement, through cooperative efforts, more comprehensive quarterly and annual sampling, consistent with existing FWS and state efforts.

Project Statement MORR-N-020: Investigate Possible Coliform Contamination Issue (Appendix A) outlines a recommended study design to address reported elevated coliform bacteria in surface and well waters at Morristown National Historical Park. This limited-term effort would attempt to determine the extent and possible sources of this contamination.

Project Statement MORR-N-021: Wetland/Riparian Zone Inventory And Assessment (Appendix A) recommends a more thorough assessment of the National Historical Park's wetland and riparian resources.

Finally, Project Statement MORR-N-022: Regulatory Protection of Park Waters (Appendix A) discusses a number of regulatory issues which the NPS should discuss cooperatively with the state of New Jersey in order to afford more complete protection to the aquatic resources contained within Morristown National Historical Park.

The implementation of these programs and their inclusion in Morristown National Historical Parks's Resource Management Plan are strongly recommended.

LITERATURE CITED

- Anderson, P.W., and S.D. Faust. 1973. Characteristics of water quality and streamflow, Passaic River Basin above Little Falls, New Jersey. U.S. Geological Survey, Water Supply Paper 2026, Washington, D.C. 79 pp.
- Ball, D.J., R.S. Hamilton, and R.M. Harrison. 1991. The influence of highway-related pollutants on environmental quality. Pages 2-47 *In* R.S. Hamilton, and R.M. Harrison, editors. Highway Pollution. Elsevier Press.
- Canace, R., Hutchinson, W.R., Saunders, W.R. and K.G. Andres. 1983. Results of the 1980-81 drought emergency ground water investigation in Morris and Passaic Counties, New Jersey. New Jersey Geological Survey, open-file report 83-3, Trenton. 132 pp.
- CH2M HILL. 1992. Data report and analysis for a study of the Great Swamp watershed. Prepared for the Great Swamp watershed Advisory Committee.
- Ehrenfeld, J. 1977. Vegetation of Morristown National Historical Park: Ecological analysis and management implications. Center for Coastal and Environmental Studies. Rutgers, The State University of New Jersey, New Brunswick (Contract CX 1600-7-0004). 164 pp.
- Ehrenfeld, J.G. and B.J. Dibeler. 1987. Vegetation of the New Jersey Brigade Area of Morristown National Historical Park. Center for Coastal and Environmental Studies. Rutgers, The State University of New Jersey, New Brunswick. 42 pp.
- Galloway, L.M. 1989. A survey of the stream benthic macroinvertebrates of Morristown National Historical Park. M. S. thesis. Rutgers, The State University of New Jersey, New Brunswick. 152 pp.
- Gill, H.E. and J. Vecchioli. 1965. The availability of ground water in Morris County, New Jersey. New Jersey Division of Water Policy and Supply. Special Report 25/ Trenton. 56 pp.
- Gill, H.E., J. Vecchioli, and W.E. Bonini. 1965. Tracing the continuity of Pleistocene aquifers in northern New Jersey by seismic methods. Groundwater, Vol 3, 4:33-35.

- Kunkle, S., W.S. Johnson, and M.D. Flora. 1987. Monitoring stream water for land use impacts. National Park Service, Ft. Collins. 102 pp. + app.
- Malanka, C. 1980. Surface water map of the Jockey Hollow Encampment Area, Morristown National Historical Park. Center for Coastal and Environmental Studies. Rutgers, The State University of New Jersey, New Brunswick (Contract CX 1600-7-0004). 1 p.
- Mele, J.A. and M.R. Mele. 1983. Final report: A water resources assessment and inventory of benthic invertebrates, fish, and amphibians of Morristown National Historical Park. Final Report: for the period of October 15, 1982 through October 15, 1983. Associated Ecologists. 81 pp.
- Mitch, W.J. and J.G. Gosselink. 1986. Wetlands. Van Nostrand Reinhold Co., New York. 539 pp.
- National Park Service. 1976. Final Master Plan - Morristown National Historical Park. National Park Service, Denver. 38 pp.
- National Park Service. 1988. Morristown National Historical Park Water Quality Manual. Morristown National Historical Park, Morristown. 5 pp.
- National Park Service. 1991. NPS-83: Public Health Management Guideline. Release No. 1. National Park Service, Washington, D.C. 25 pp.
- Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. Rapid bioassessment protocols for use in streams and rivers: benthic macroinvertebrates and fish. U. S. Environmental Protection Agency, Washington, D.C. EPA/440/4-89/001.
- Robichaud, B. and M.F. Buell. 1973. Vegetation of New Jersey. Rutgers University Press, New Jersey. New Brunswick. 340 pp.
- Tiner, R.W., Jr. 1985. Wetlands of New Jersey. U.S. Fish and Wildlife Service, National Wetlands Inventory. Newton Corner. 117 pp.
- Trama, F.B. and L.M. Galloway. 1988. Morristown National Historical Park watershed study: Phase II - Aquatic Resources. Center for Coastal and Environmental Studies. Rutgers, The State University of New Jersey, New Brunswick (Contract 4-02-8217 DI-NPS-0006). 108 pp.

Van Abs, D.J. 1983. The hydrogeology of the buried valley aquifer system. Passaic River Coalition. Basking Ridge. 137 pp. + app.

Vecchioli, J. and W.D. Nichols. 1966. Results of the drought-disaster test-drilling program near Morristown, New Jersey. New Jersey Geological Survey, Water Resources Circular No. 16, Trenton. 48 pp.

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APPENDIX A

Proposed Water Resource-related Project Statements

MORR-N-001	Monitoring Long-Term Water Quality Trend
MORR-N-020	Investigate Possible Coliform Contamination Issue
MORR-N-021	Wetland/Riparian Zone Inventory and Assessment
MORR-N-022	Enhance Regulatory Protection for Park Waters

PROJECT NUMBER: MORR-N-001.000

TITLE: MONITORING LONG TERM WATER QUALITY TRENDS

FUNDING STATUS: FUNDED: 4.00 UNFUNDED: 70.00

SERVICEWIDE ISSUES: N11 WATER QUAL-EXT

CULTURAL RESOURCE TYPE CODE: N/A

10-238 PACKAGE NUMBER:

PROBLEM STATEMENT:

Surface water features in Morristown National Historical Park (MORR) include most of the headwaters of Primrose Brook, the headwaters of Jersey Brook, a 1/2 mile reach of the Upper Passaic River and a 1/2 mile reach of Indian Grave Brook. In addition, 3 marshes and a small artificial pond (Cat Swamp Pond) are also located within Morristown National Historical Park.

While generally high water quality exists within the streams flowing through Morristown National Historical Park, changing land-use patterns have generated serious point source and non-point source water quality problems in other areas of the Upper Passaic River/Great Swamp Watershed. Within the National Historical Park, there is a concern that non-point source pollutants associated with surrounding suburban sources could impact the existing high water quality. These sources include potential contamination from sub-division/commercial development, highway runoff, application of golf course, lawn and garden chemicals, septic tank leachate, and leaking underground storage tanks.

While a program to monitor all of the possible impacts from the various non-point sources would be extremely costly and is not warranted, a recently completed Water Resources Scoping Report (NPS,1993) identified several water quality concerns that require management awareness. These include the long-term impacts of upper watershed development upon the Upper Passaic River and Indian Grave Brook, the potential impacts associated with adjacent (Military Hill) and within park development (NPS facilities) upon Primrose Brook, and the possible effects of runoff from Tempe Wick Road upon Jersey Brook.

The report further recommended the implementation of a long-term monitoring program designed to provide a more complete assessment of baseline water quality, "flag" potential degradation resulting from non-point source contamination, and periodically appraise the health of the aquatic biological community.

DESCRIPTION OF RECOMMENDED PROJECT OR ACTIVITY:

The MORR Water Resources Scoping Report recommends the monitoring of long-term water quality trends by the implementation of a monitoring program which consists of three components including a monthly monitoring program implemented cooperatively by the NPS and volunteer citizen's monitoring groups, the quarterly sampling of 15 physical and chemical water quality parameters monitored throughout the Great Swamp watershed (cooperative NPS and US Fish & Wildlife Service program), and an annual Level II Rapid Bioassessment monitoring following protocols developed by the U.S. Environmental Protection Agency. Six in-park stations were identified for this monitoring program including sites on the Upper Passaic River, Primrose Brook, Jersey Brook, and Indian Grave Brook. In addition, the continuation of one-year intensive studies on a periodic (15-20 year) basis was also recommended.

The implementation of this multi-faceted water quality monitoring program will require expertise and laboratory resources extending beyond the current resources within MORR. In the short term, MORR proposes to work with local agencies such as the State of New Jersey Department of Environmental Protection and Energy and the U.S. Fish and Wildlife Service, the Water Resources Division, and appropriate local universities capable of providing the necessary field equipment, laboratory resources, QA/QC protocols for recommended field sampling and laboratory analysis.

However, over the long term, there is the need to implement a consistent and coordinated approach for developing monitoring guidance, providing technical support, establishing QA/QC protocols, and implementing appropriate database management, data evaluation, and reporting procedures for a number of small NPS units, that require some degree of water resources monitoring but do not warrant the addition of a staff water resource professional. MORR will encourage NPS staffing and support at the regional/intra-regional level in order to coordinate and implement water resources monitoring activities for the numerous small parks within the North Atlantic and Mid-Atlantic Regions requiring these programs.

Funding requested here is designed to provide support to meet the annual costs of the long-term water quality monitoring program recommended in the Morristown National Historical Park Water Resources Scoping Report. Additional funding for the recommended one-year intensive assessment (\$75,000 - \$100,000) will not be necessary within the next 5-10 years unless major degradation of water resources is noted during the routine monitoring program.

Literature Cited

National Park Service. 1993. Morristown National Historical Park Water Resources Scoping Report. Water Resources Division, Fort Collins and NPS Coastal Research Center, University of Rhode Island.

BUDGET AND FTEs:

----- FUNDED				
	Source	Act Type	Budget (\$1000s)	FTEs
Year 1:	PKBASE-NR	MON	1.00	0.1
Year 2:	PKBASE-NR	MON	1.00	0.1
Year 3:	PKBASE-NR	MON	1.00	0.1
Year 4:	PKBASE-NR	MON	1.00	0.1
Total:			4.00	0.4
----- UNFUNDED				
	Source	Act Type	Budget (\$1000s)	FTEs
Year. 1:	PKBASE-NR	MON	17.50	0.2
Year 2:	PKBASE-NR	MON	17.50	0.2
Year 3:	PKBASE-NR	MON	17.50	0.2
Year 4:	PKBASE-NR	MON	17.50	0.2
Total:			70.00	0.8

(OPTIONAL) ALTERNATIVE ACTIONS/SOLUTIONS AND IMPACTS:

Under a NO ACTION ALTERNATIVE, Morristown National Historical Park will continue to cooperate with other federal and state agencies who sometimes use a site in Primrose Brook as a "background" site when studying broader water quality issues in the Great Basin Watershed. While these data provide a useful reference point, they are not adequate to address water quality trends within MORR nor are they sufficient to provide adequate information relating to specific water resource-related issues.

Under a PERIODIC ASSESSMENT OF SURFACE WATER BIOLOGICAL INTEGRITY ALTERNATIVE, MORR would seek funding to conduct periodic intensive inventories of physical and chemical water quality conditions, macroinvertebrate diversity and community structure,

and fisheries, undertaken at 5-10 year intervals.

The first intensive inventory was conducted in 1982-1983 by Mele and Mele (1983). This one-year study focussed on seasonal differences in physical and chemical water quality conditions, fecal coliform bacterial levels, macroinvertebrate diversity, and a fisheries survey.

A second intensive inventory conducted in 1986-87 by Trama and Galloway (1988), provided more complete information on the physical, chemical, and biological characteristics of the four permanent stream systems found within MORR.

The cost to implement an intensive one-year study to assess the biological integrity of the surface waters of MORR is currently estimated to be approximately \$60,000.

Literature Cited

Mele, J.A. and M.R. Mele. 1983. Final report: A water resources assessment and inventory of benthic invertebrates, fish, and amphibians of Morristown National Historical Park. Final report: for the period of October 15, 1982 through October 15, 1983. Associated Ecologists. 81 pp.

Trams, F.B. and L.M. Galloway. 1988. Morristown National Historical Park water shed study: Phase II - Aquatic Resources. Center for Coastal and Environmental Studies, Rutgers - The State University of New Jersey (Contract 4-02-8217 DI NPS-0006), New Brunswick, NJ 108 pp.

COMPLIANCE CODE(s):

EXPLANATION:

Proposal Date: 93

PROJECT NUMBER: MORR-N-020.000

TITLE: INVESTIGATE POSSIBLE COLIFORM CONTAMINATION ISSUE

FUNDING STATUS: FUNDED: 0.00 UNFUNDED: 50.00

SERVICEWIDE ISSUES: N11 WATER QUAL-EXT

CULTURAL RESOURCE TYPE CODE: N/A

10-238 PACKAGE NUMBER:

PROBLEM STATEMENT:

Primrose Brook, located in the Jockey Hollow Encampment Area, lies within the most pristine drainage of Morristown National Historical Park (MORR). While most of the springs which contribute to the headwaters of this stream surface within the boundary of MORR, the source spring of the East Branch Primrose Brook surfaces in an area known as Military Hill, which is located in a private sub-division just outside the northeastern boundary of the park. Jersey Brook, a tributary to Primrose Brook, originates from springs located in the southwestern portion of the Jockey Hollow Encampment Area.

From the fall of 1982 through the fall of 1983, Mele and Mele (1983) conducted quarterly fecal coliform bacterial monitoring at five stream locations throughout MORR. While fecal coliform bacteria levels were generally low (0 - 150 organisms/100 mL), slightly elevated fecal coliform levels were detected in the East Branch Primrose Brook and in Jersey Brook.

Additional bacterial monitoring (fecal coliform and fecal streptococcus) was conducted quarterly in 1986-1987 by Trama and Galloway (1988). Again levels were found to be generally low, with the exception of summer samples at two sites along the West Branch Primrose Brook, and a single summer sample exceeding 200 colonies/100mL in each of Indian Grave Brook and Jersey Brook..

More recently, the NPS has been forced to limit the use of water in two shallow groundwater wells located within the park, because high bacterial levels indicating possible contamination.

While the source of this possible bacterial contamination has not been determined, it is possible that it may be related to the high deer population or other wildlife that occur in the Jockey Hollow Encampment Area. However, possible contamination from septic leachate emanating from park visitor and administrative facilities, park residences, or adjacent private home development cannot be ruled out.

In addition, the septic system leach field for Quarters #45 (New

Jersey Brigade Unit) is located within 100 feet of Indian Grave Brook. This leachfield is located just below the surface and the ground above this leachfield is often reported to be "wet and mushy" even during the dry season (NPS,1993). While bacteriological monitoring in Indian Grave Brook pre-dates development on this site potential contamination of Indian Grave Brook from this leachfield should be evaluated.

Literature Cited

Mele, J.A. and M.R. Mele. 1983. Final Report: A water resources assessment and inventory of benthic invertebrates, fish, and amphibians of Morristown National Historical Park. Final report: for the period of October 15, 1982 through October 15, 1983. Associated Ecologists. 81 pp.

National Park Service. 1993. Morristown National Historical Park Water Resources Scoping Report. Water Resources Division, Fort Collins and NPS Coastal Research Center, University of Rhode Island.

Trama, F.B. and L.M. Galloway. 1988. Morristown National Historical Park watershed study: Phase II - Aquatic Resources. Center for Coastal and Environmental Studies, Rutgers - The State University of New Jersey (Contract 4-02-8217 DI NPS-0006), New Brunswick, NJ 108 pp.

DESCRIPTION OF RECOMMENDED PROJECT OR ACTIVITY:

A two-year intensive study is proposed to evaluate the extent of bacterial contamination (surface and ground water) and possible sources of contamination within the Jockey Hollow and New Jersey Brigade Encampment Areas of Morristown National Historical Park.

Monitoring would consist of 1) undertaking a comprehensive sanitary survey to identify possible sources of bacterial contamination; 2) the installation and bi-weekly monitoring of groundwater wells or lysimeters located between existing septic fields and the streams; 3) monthly sampling for fecal coliform and Enterococci bacteria at appropriate surface water sites and wells throughout the Jockey Hollow and New Jersey Brigade Encampment Areas; 4) implementing appropriate laboratory verification techniques to identify if the sources are human or wildlife related; and 5) conducting special tracer studies to isolate any possible human sources of contamination.

Should contamination be found and sources identified, appropriate mitigation alternatives would be analyzed.

BUDGET AND FTEs:

----- FUNDED -----				
	Source	Act Type	Budget (\$1000s)	FTEs
Year 1:				
Year 2:				
Year 3:				
Year 4:				
Total:			0.00	0.0

----- UNFUNDED -----				
	Source	Act Type	Budget (\$1000s)	FTEs
Year 1:	WATER-RES	RES	40.00	0.2
1:	PKBASE-NR	ADM	0.00	0.1
Subtotal:			40.00	0.3
Year 2:	WATER-RES	RES	10.00	0.1
Year 3:				
Year 4:				
Total:			50.00	0.4

(OPTIONAL) ALTERNATIVE ACTIONS/SOLUTIONS AND IMPACTS:

Under a NO ACTION ALTERNATIVE this possible water quality problem would continue to exist, potentially affecting resource condition and water supplies throughout the Jockey Hollow Encampment Area.

COMPLIANCE CODE(s):

EXPLANATION:

Proposal Date: 93

PROJECT NUMBER: MORR-N-021,000

TITLE: WETLAND/RIPARIAN ZONE INVENTORY & ASSESSMENT

FUNDING STATUS: FUNDED: 0.00 UNFUNDED: 30.00

SERVICEWIDE ISSUES: N20 BASELINE DATA N24 OTHER

CULTURAL RESOURCE TYPE CODE: N/A

10-238 PACKAGE NUMBER:

PROBLEM STATEMENT:

There is a critical lack of information on the wetlands of Morristown National Historical Park (NPS,1993). A wetland and riparian habitat map is needed, along with inventories of flora (e.g., species composition and structure) and fauna (e.g., small mammals, reptiles and amphibians, birds) within wetland habitats. Given detailed maps and inventories, resource managers will be able to detect the responses of wetlands and riparian zones to various natural and human-induced disturbances. A mapping and inventory effort will be necessary to address the following resource management issues;

- Response of wetland and riparian zones to intensive browsing by deer;
- Response of rare wetland-dependent biota and associated critical habitat to water quality and hydrological stresses;
- Understand and predict changes in wetland boundaries and community structure in response to natural (e.g., floods, wind produced canopy gaps, browsing) and human-induced (e.g., water withdrawals, groundwater level changes, water quality degradation, sedimentation, etc.) factors;
- Provide baseline for effective visitor use planning (e.g., placement of visitor facilities, design of interpretive walks, etc.)

When the wetland and riparian zone assessment is coupled with aquatic surveys (e.g., fishes), water quality monitoring, deer population monitoring, and upland vegetation surveys, resource managers will have many of the data sets necessary to make well-informed resource protection decisions. Morristown National Historical Park, located in an urbanizing ecosystem just 30 miles from New York City, requires essential baseline data sets for effective resource management.

Literature Cited

National Park Service. 1993. Morristown National Historical Park Water Resources Scoping Report. Water Resources Division, Fort Collins and NPS Coastal Research Center, University of Rhode Island.

DESCRIPTION OF RECOMMENDED PROJECT OR ACTIVITY:

A one-year wetland mapping and assessment program is recommended. Two phases include, 1) wetland and riparian zone mapping, and 2) field inventory and ground truthing. It is recommended that a large scale (perhaps 1:4800 or 1"-400') digital wetland map be produced. Ideally, this task should not be limited to wetlands, but done in conjunction with a park-wide vegetation or cover-type mapping exercise. Aerial photography libraries should be first visited to determine if existing or recent (within past 3 years) coverage is available. It is recommended that the National Wetlands Inventory (NWI) wetlands classification scheme be adopted. This will maintain consistency with the Great Swamp NWR, as well as provide the opportunity for conducting change analysis with the existing (albeit small scale, 1:24,000) NWI maps.

On completion of the wetlands maps, a detailed field inventory should be conducted. The field team should conduct a broad survey to produce plant and animal species lists for each wetland type mapped. This broad survey should be followed by more intensive field efforts at select sites for each wetland type. Care should be taken in site selection to insure that a diversity of sites are studied (i.e., developed vs less-developed watersheds, broad vs narrow wetlands, proximity to permanent upland sampling or previous study sites, and other criteria). Intensive field studies should include establishment of quantitative vegetation plots or transects to evaluate species composition and community structure, small mammal and herptile trapping, and the study of relationships between soil type, water table levels, and stream water quality. The intensive field effort should be conducted to encompass all seasonal conditions.

The Final Report should include maps of the park with wetland types identified. Statistics of area of each wetland type within watersheds and subwatersheds should be included. A written description for each wetland type and study area, identifying species composition and ecological dynamics of the system will be particularly useful to resource managers and interpretive staffs.

BUDGET AND FTEs:

----- FUNDED -----			
Source	Act	Type Budget (\$1000s)	FTEs

Year 1:

PROJECT STATEMENT SHEET

MORR-N-021.000
PS Page: 0003

Year 2:

Year 3:

Year 4:

Total:	<hr/>	0.00	0.0
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----- UNFUNDED -----				
	Source	Act Type	Budget (\$1000s)	FTEs
Year 1:	WATER-RES	RES	30.00	0.0
	PKBASE-NR	ADM	0.00	0.1
			<hr/>	
		Subtotal:	30.00	0.1

Year 2:

Year 3:

Year 4:

Total:	<hr/>	30.00	0.1
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(OPTIONAL) ALTERNATIVE ACTIONS/SOLUTIONS AND IMPACTS: N/A

COMPLIANCE CODE(s):

EXPLANATION:

Proposal Date: 93

PROJECT NUMBER: MORR-N-022.000

TITLE: ENHANCE REGULATORY PROTECTION FOR PARK WATERS

FUNDING STATUS: FUNDED: 0.00 UNFUNDED: 0.00

SERVICEWIDE ISSUES: N11 WATER QUAL-EXT

CULTURAL RESOURCE TYPE CODE: N/A

10-238 PACKAGE NUMBER:

PROBLEM STATEMENT:

Surface waters within Morristown National Historical Park are currently of high quality and support a diverse and balanced fish community including the native Eastern brook trout, and two introduced salmonids, the rainbow trout and the brown trout (NPS, 1993).

The waters within Morristown National Historical Park are protected by the State of New Jersey Water Quality Standards. Primrose Brook, and its tributary Jersey Brook are currently designated as FW-2 Trout Production Waters, affording relatively strong water quality protection. This designation is also being considered at this time for the Upper Passaic River (source to Route 202) and Indian Grave Brook.

Primrose Brook is also recognized as Category One (antidegradation) Waters, though this is not the case for the Upper Passaic River (source to Route 202) or Indian Grave Brook. In accordance with State of New Jersey Water Quality Standards, Category One (antidegradation) Waters are further protected from "measurable changes to existing water quality."

In 1992, the State of New Jersey further listed the Upper Passaic River (source to Route 202) and Indian Grave Brook as "Wild Trout Streams" which provides a level of protection by eliminating fish stocking activities and establishing more stringent fishing regulations. Because of their limited sport fishing potential, Primrose Brook and Jersey Brook were not provided this designation.

Literature Cited

National Park Service. 1993. Morristown National Historical Park Water Resources Scoping Report. Water Resources Division, Fort Collins and NPS Coastal Research Center, University of Rhode Island.

Proposal Date: 93

DESCRIPTION OF RECOMMENDED PROJECT OR ACTIVITY:

Morristown National Historical Park should continue its cooperation with the State of New Jersey in order to protect the water quality and fisheries resources within the waters of Morristown National Historical Park.

The National Park Service should request that the New Jersey Department of Environmental Protection and Energy consider classifying the segment of the Passaic River from its source to Route 202 as Category One (antidegradation) Waters.

While fishing in Primrose Brook and Jersey Brook is not common, the National Park Service and the New Jersey Division of Fish, Game and Wildlife need to evaluate if special fishing regulations are appropriate in order to protect the range-limited but viable population of Eastern brook trout in the Primrose Brook headwaters. The establishment of a "no fishing" regulation for the Primrose Brook headwaters and Jersey Brook is strongly encouraged.

North Atlantic Region is encouraged to request technical assistance in pursuing these activities from the Water Resources Division.

BUDGET AND FTEs:

----- FUNDED -----				
	Source	Act Type	Budget (\$1000s)	FTEs
Year 1:	PKBASE-NR	PRO	0.00	0.1
	WATER-RES	PRO	0.00	0.1

		Subtotal:	0.00	0.2
Year 2:				
Year 3:				
Year 4:				
		Total:	0.00	0.2

----- UNFUNDED -----				
	Source	Act Type	Budget (\$1000s)	FTEs
Year 1:				
Year 2:				
Year 3:				

Year 4:

Total:	0.00	0.0
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(OPTIONAL) ALTERNATIVE ACTIONS/SOLUTIONS AND IMPACTS: N/A

COMPLIANCE CODE(s):

EXPLANATION:

Proposal Date: 93



As the nation's principal conservation agency, the Department of the Interior has the responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.